The Role of Benthic Periphyton Mats in Regulating Macrophyte Communities in a Marl Prairie Wetland

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INTRODUCTION

Macrophytes and periphyton mats are Everglades' ecosystem engineers (Gaiser et al., 2011; Lacoul and Freedman, 2006; Thomaz and Cunha, 2010).

The most productive mats coexist with abundant *Cladium jamaicense* and *Muhlenbergia filipes* in short-hydroperiod marl prairies, where they support threatened and endangered species pressured by the urban boundary and wetland draining (Davis et al., 2005).

Understanding the extent of macrophyte and microbial mat interactions is critical for predicting the direct and indirect ecological impacts of hydrologic modifications on both communities.

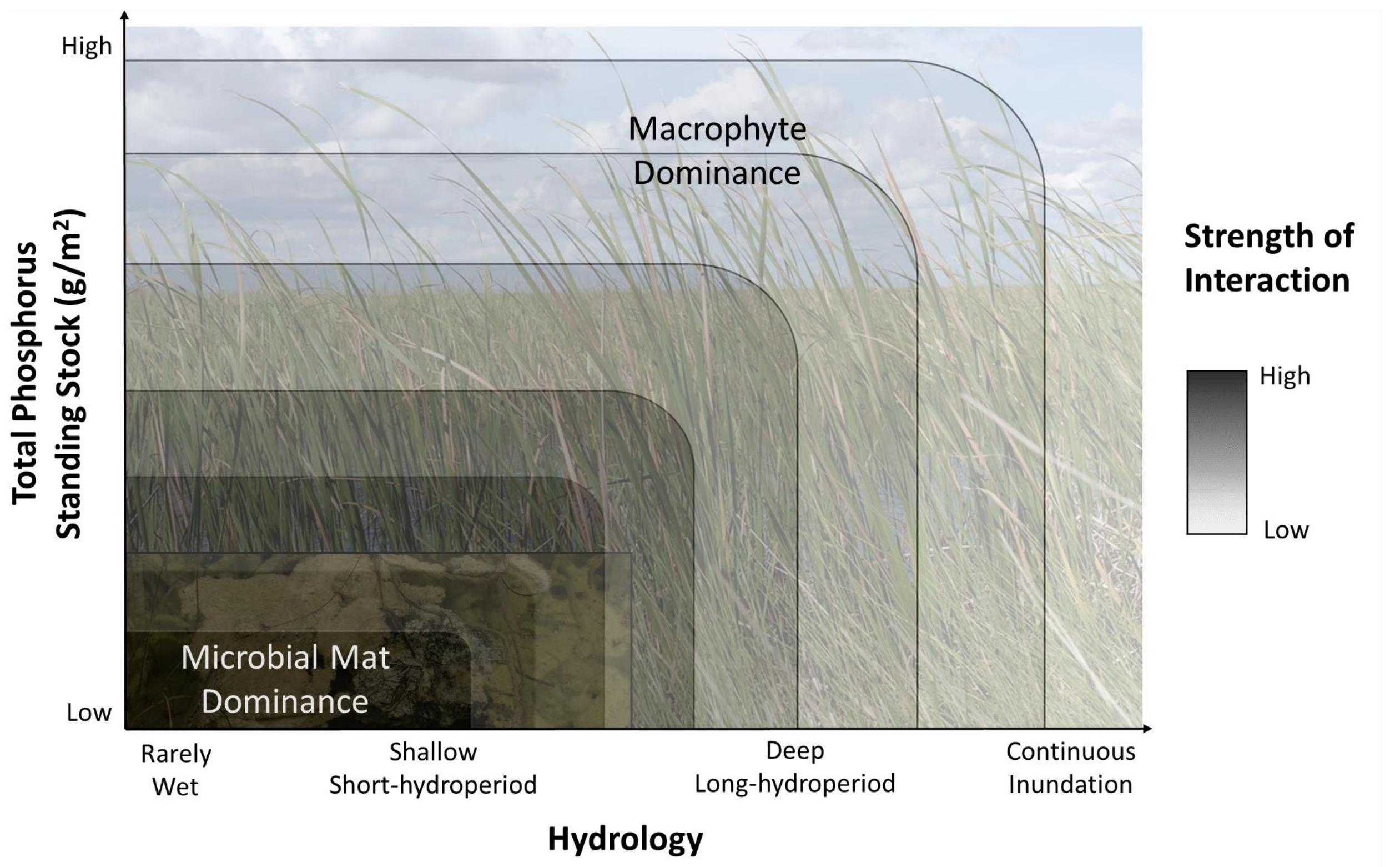


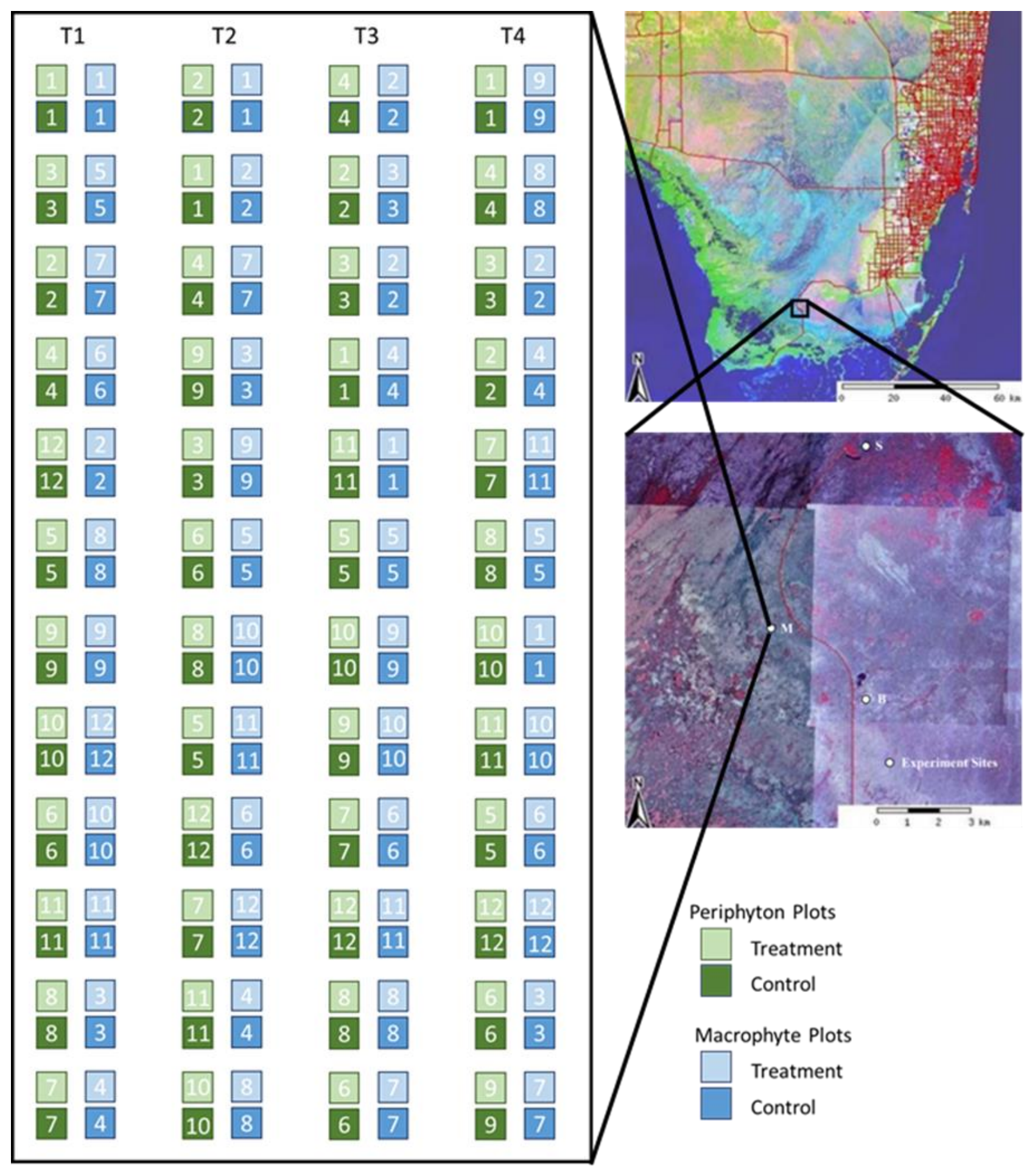
Figure 1: The strength of macrophyte-microbial mat interactions along the nutrient subsidy-stress gradient and hydrologic regime in oligotrophic wetlands and the environmental conditions at which either community dominates or displaces the other.

QUESTIONS

How do periphyton mats and macrophytes influence each other's production in wet prairies? How do mats influence macrophyte community structure?

METHODS

- ○ Three sites with contrasting hydroperiods each contained four 50 m transects
- ○ 24 pairs of treatment and control plots per transect; 12 each for macrophyte (MR) and periphyton removal (PR); MR plot pairs contained dense macrophytes and PR plot pairs contained high periphyton biomass
- ○ Macrophytes/mats were removed bimonthly from May 2003 -2004 and after treatment, one pair of MR and PR plots were harvested bimonthly at each transect until all sites were sampled at the end of April 2006.



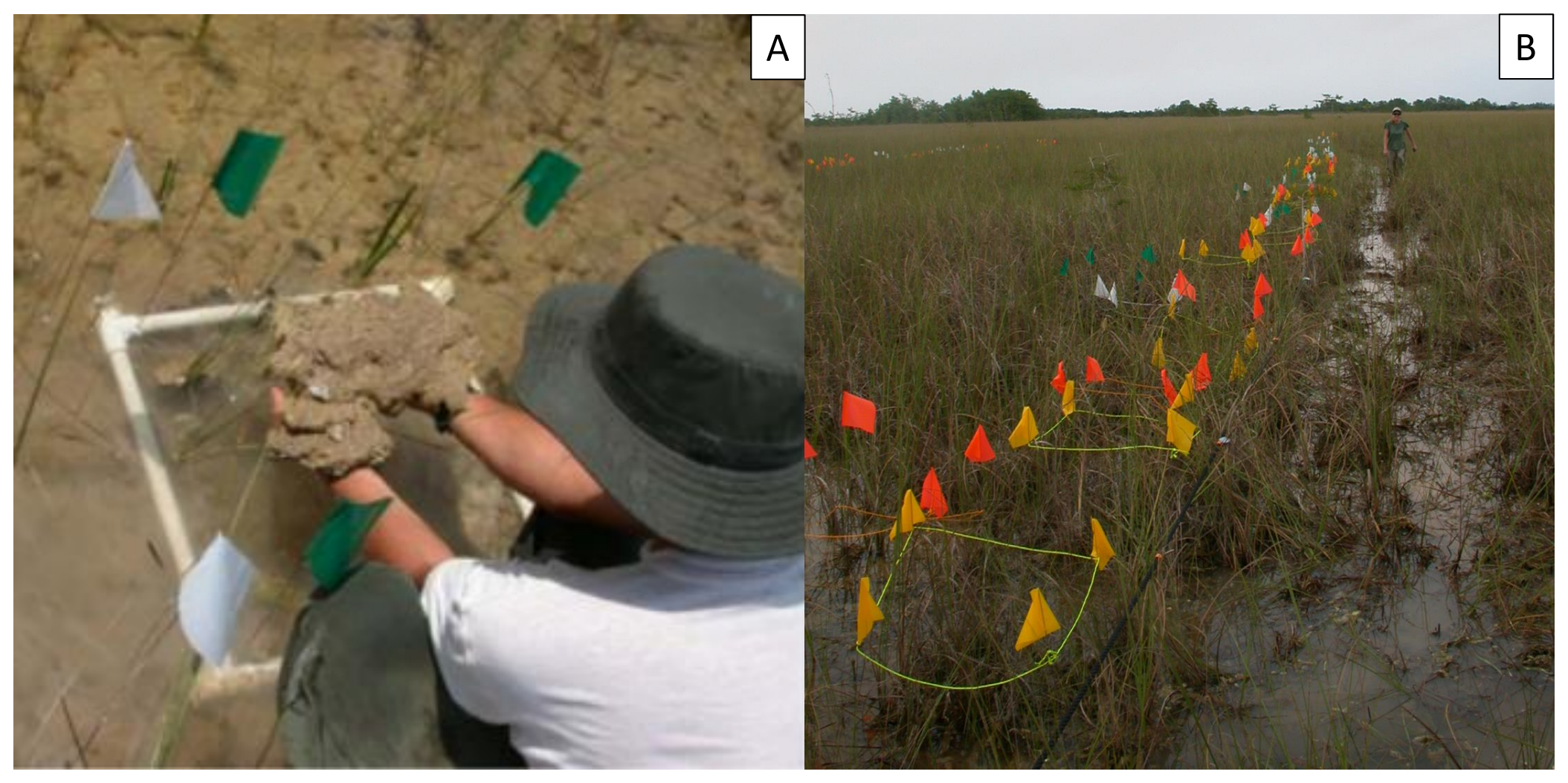


Figure 2: Locations of the three sampling sites in southern Everglades National Park and the experimental set-up for each site. Numbers in each plot represent the random selection of plot pairs for bimonthly harvesting.

Figure 3: A) Felipe Zuñiga removing periphyton by hand from a 0.25m² plot.
B) A transect of control and treatment plots.

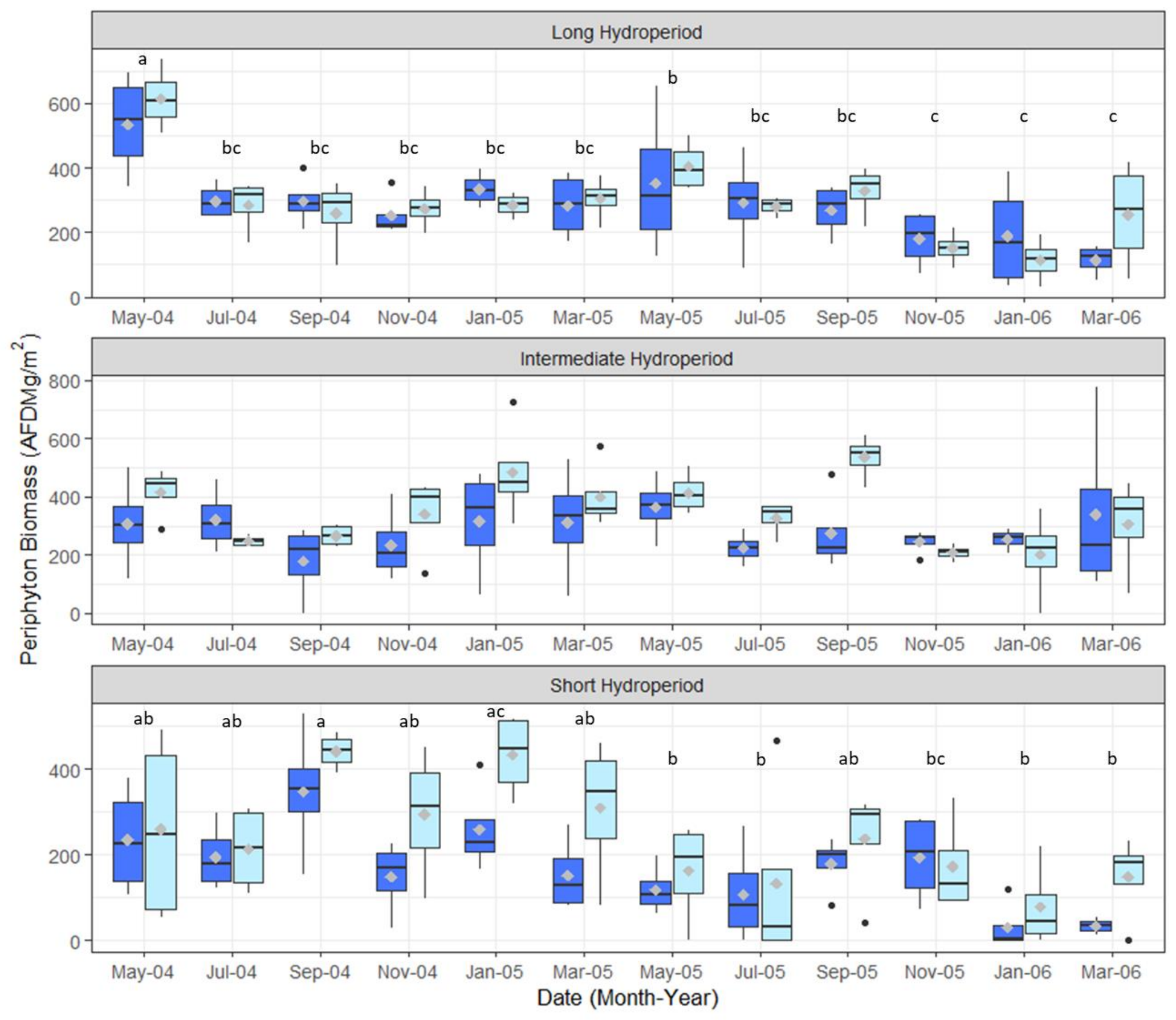


Figure 4: Boxplots of periphyton mat biomass (AFDM g/m²) in control and treatment macrophyte removal plots over the 24 months of harvesting at the three sites. Grey points indicate biomass mean. Letters above boxplots indicate significant differences among months since harvest treatment.

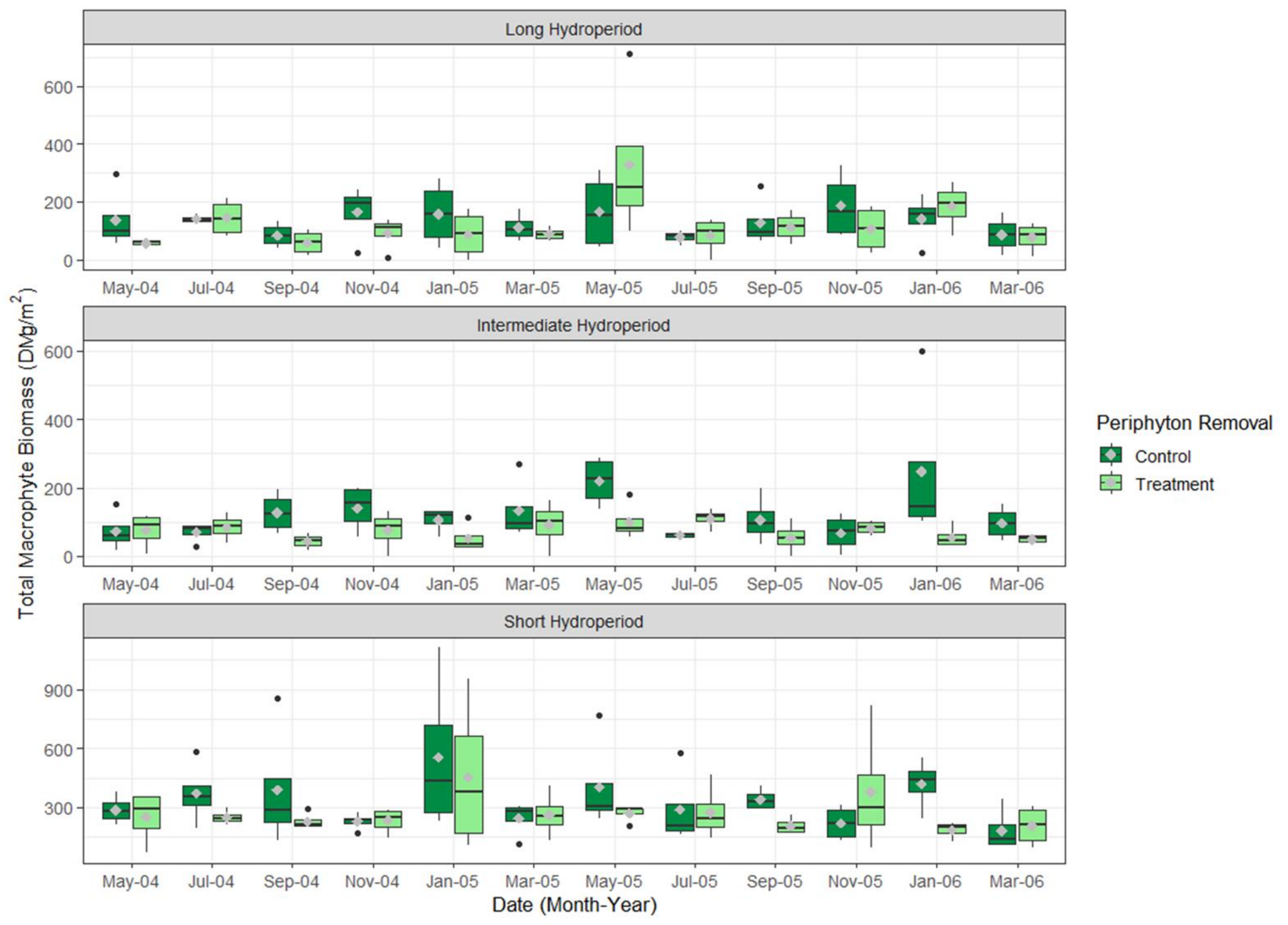
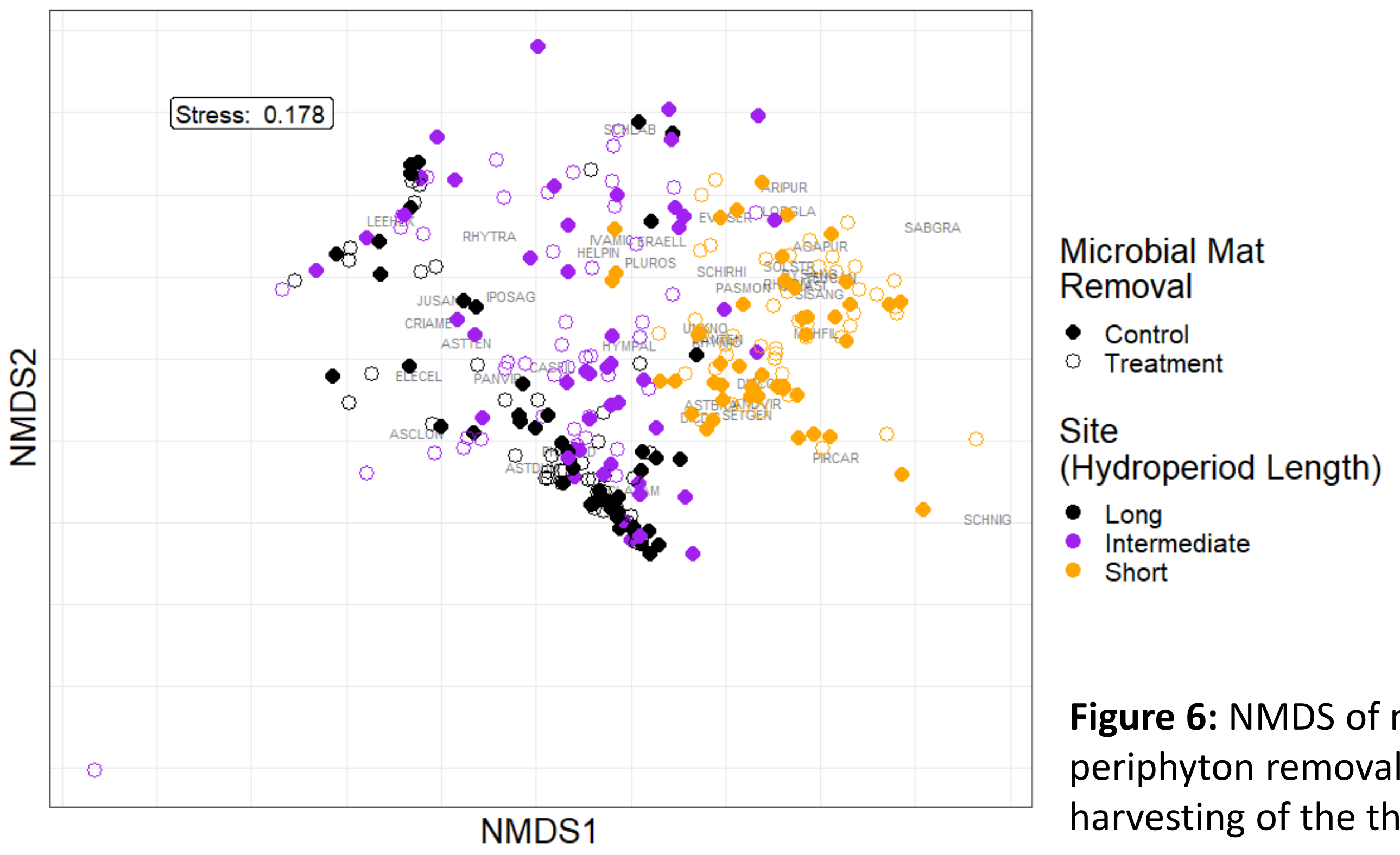


Figure 5: Boxplots of macrophyte total biomass (DM g/m²) in control and treatment periphyton removal plots over the 24 months of harvesting at the three sites.



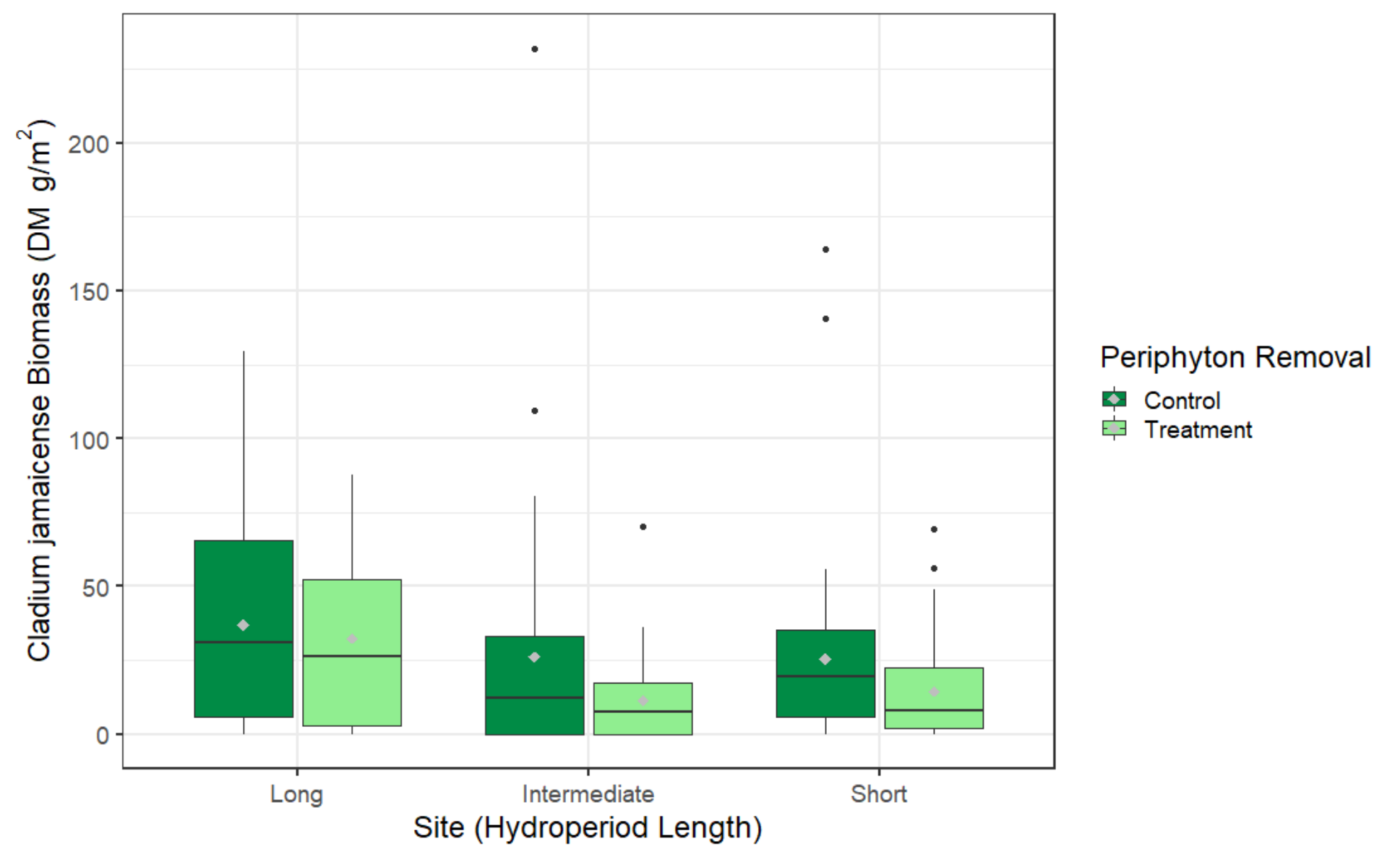


Figure 7: Boxplot of *C. jamaicense* biomass (DM g/m²) in control and treatment periphyton removal plots at the three sites.

Figure 6: NMDS of macrophyte species biomass (DM g/m²) from periphyton removal control and treatment plots over the 24 months of harvesting of the three sites.

RESULTS

- ○ Periphyton biomass was lower at the short hydroperiod site than the long and intermediate sites; biomass increased with macrophyte removal at the short and intermediate hydroperiod sites, with directional change in biomass over time at the long and short hydroperiod sites (Fig. 4).
- ○ Macrophyte total biomass was greater at the short hydroperiod site than the long and intermediate sites; biomass decreased with periphyton removal at the intermediate hydroperiod site (Fig. 5).
- ○ Macrophyte community structure was distinctly different among sites but was not impacted by periphyton removal (Fig. 6).
- ○ When examining each macrophyte species separately, the biomass of the dominant *C. jamaicense* decreased when periphyton was removed (Fig. 7).

DISCUSSION

- ○ **Removal of macrophytes increased periphyton biomass, while removal of periphyton reduced macrophyte biomass. Removal effects were more pronounced in the shorter hydroperiod sites, suggesting periphyton may play an important role in providing protection from desiccation.**
- ○ Periphyton mat absence directly impacts macrophyte biomass through the decrease in *C. jamaicense* stems but does not influence the community structure or abundance of other macrophyte species,
- ○ Freshwater pulses may influence the intensity of interactions between periphyton mats and macrophytes and alter ecosystem biomass allocation in short-hydroperiod wetlands.

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References